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ERP IMPACT ON STRATEGIC FLEXIBILITY OF THE FIRM: THE CASE OF TUNISIAN SME'S

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Abstract

The impact of the ERP (enterprise resource planning) on the company's flexibility is at the center of a controversy. While some researchers emphasize the positive contribution of the ERP in terms of flexibility, others emphasize its rigid nature.

This paper aims to validate the positive impact of ERP's integration on the strategic flexibility of Tunisian firms. As this impact is not obviously strong and positive, we choose to introduce three moderating variables: the number of modules, the firm size and the period following the installation of the ERP.

The empirical analysis shows that the ERP, measured by its integration capacity, has a positive impact only on reactive strategic flexibility. The findings also show that moderating variables have no effect on the relationship ERP/flexibility.

Keywords: Enterprise Resource Planning (ERP), Integration, Strategic flexibility.

INTRODUCTION

Nowadays, customers are more demanding and better informed and competition is tougher (Bidan et al. 2002, Reix 1999). Accordingly, firms struggle to develop their capacity of adaptation to survive and protect their competitive position (Bidan et al. 2002). The strategic flexibility could support this firm's ability to adapt to changes and to also be a source of some of these changes (Karri 2001). The firm response to these changes, whether internal or external they are, is adjusting its goals to its skills and key resources. The strategic flexibility also reflects the organization's ability to change and create new strategies to move more quickly between various markets (De Toni and Tonchia 2005).

Researchers argue that ERP is a real flexibility issue for organizations (Markus and Tanis 1999, Gattiker and Goodhue 2004, Beheshti 2006, Masini 2003, Lee 2001, Nicolaou 2004, Holsapple and Sena 2005). Indeed lots of firms are moving towards an ERP system. Lengnick-Hall et al. (2004) note that ERP can be a set of strategic resources. Robust resources enable firms to manage their activities in real time through accurate and reliable information. They help accelerating information flow in the firm and reduce the time needed for several operations and transactions. Therefore, the firm is able to respond quickly to the demands of its customers and suppliers. This way, it reaches a flexible relationship with its environment.

However, ERP may also be a source of organizational rigidity (Batra 2006, Benghozi 2001, Lemaire 2002, Bidan et al. 2002, Gomez 2002). In response to the perceived problematic nature of ERP impact on flexibility, there has been a growing literature on the integrative effect of the ERP, particularly in SME's. This paper aims to contribute to this emerging literature.

The paper focuses on the issue of the impact of ERP integration on strategic flexibility. In particular it examines the contribution that various ERP integration components (information, functional and technical components) can have positive impact on strategic flexibility (the reactive form). The paper also studies the moderating effect of the variables :number of modules, firm size and period following the installation of the ERP on the relationship ERP/ flexibility.

These relationships were analyzed using data from 50 SME's. The evidence supported partially expectations. In the first part of this paper, we present the conceptual framework of the study. Then, we introduce how ERP can be a tool of flexibility. In the third section of this paper, we present the hypothesis and the research model. In the fourth section, we focus on the methodology and the results. Lastly, in the fifth section we discuss the study results.

1 CONCEPTUAL FRAMEWORK

The basic concepts explored in this research are ERP-more precisely its integrative effect- and strategic flexibility. We discuss in this paragraph the definition of these concepts.

1.1 ERP, a definition

"ERP is a set of application modules, working in native mode on a single database, in the logical sense of the term (although it is geographically distributed over a network)" (Tomas 2002). The ERP is characterized by its modular architecture, the uniqueness of its database, the standardization of its processes and the possibility of adaptation and integration it offers to the firm.

Barki and Pinsonneault (2002), Rowe (1999)[1], Lequeux (1999)[2] and Davenport (1998) focus on integration strength of the ERP system. It is even the reason for ERP adoption by firms looking for standardising their IS, to connect functional departments that were separated and improve

[1] Rowe (1999) in Uwizeyemungu, S. and Raymond, L. (2004). Integration, flexibility and transversality: essential characteristics of ERP systems. *Databases and Information Systems Integration*, ICEIS, 70-77.
[2] idem.

communication with their external partners (using the CRM: customer relationship management, and SCM: Supply chain management) (Bidan et al. 2002).

In parallel, the environment complexity imposes a perfect integration of business units to manage, at the same time, change and firm's activities (Beretta 2004). Hence, firms choose, increasingly, investing in technologies such as ERP to ensure integration between their different functions. Consequently, firms become flexible and able to deal with change (Beretta 2004).

In addition, ERP integration is its ability to make information accessible throughout the hierarchical level from the lowest to the highest one. Information flows not only in bottom up way. It is available for any employee who needs it (Beretta 2004).

1.2 Strategic flexibility

Defining measures or trying to identify all aspects of flexibility is difficult regarding the multidimensionality and complexity of this concept (Golden and Powell 2000, Tarondeau 1999, Sethi and Sethi 1990). As we aim to understand the deepest effect of the ERP on firm adaptability, we choose to focus on strategic flexibility. This latter is the company's ability to adapt to changes and also to be a source of some of these changes (Karri 2001). Moreover, the strategic flexibility reflects the organization's ability to change and create new strategies to move more quickly between various markets (De Toni and Tonchia 2005).

Karri (2001) highlights both forms of strategic flexibility, offensive and defensive one, combined with tow dimensions of it: the proactive and the reactive strategy. The first one implies that the firm changes its environment by disrupting its competitors and indirectly control them. The second one reflects the firm's ability to better adapt to environment changes. SMEs are more likely to be closer to the reactive dimension of strategic flexibility.

2 ERP; A TOOL OF FLEXIBILITY

At this level, the question is how can ERP be a tool of flexibility. There are many organizational aspects that point out the positive impact of ERP on the firm flexibility. First, ERP is a means for upgrading employees' work. Secondly, it improves organisation structure.

2.1 The RBV (resource based view) approach

By adopting the RBV, Lengnick-Hall et al. (2004) confirm how firms can use ERP to improve its flexibility. They validate that ERP can be a set of strategic resources. A resource qualified as "robust" cause it enables the firm to manage its activities in real time based on accurate and reliable information. It also helps accelerate the flow of information in the corporation and reduce the time needed for various operations and transactions. Thus, it gives the company a rapid response to any change. Thus, ERP can improve firm flexibility.

The ERP is also a positive development of firm's relations with its various partners. Hence, it is able to act quickly to the demands of its customers and suppliers. In this way, it achieves a flexible relationship with its external environment.
Therefore, to have a sustainable competitive advantage from the ERP and superior flexibility, Lengnick-Hall et al. (2004) propose to benefit from of ERP integration. Likewise, ERP users should have technical and organizational skills needed to operate rapid changes in the ERP and this in response to any environmental change. They should also use the ERP to achieve a mass customization of the firm's products in order to be different from competitors.

Moreover, this software allows firm to develop business relationships with external partners in order to seize important opportunities. But foremost, social and intellectual capital is central when it's able to take advantage of the potential of the ERP. Indeed, firm's culture and learning ability of its employees are a key factor in achieving a sustainable competitive advantage and improving flexibility through ERP.

2.2 Organizational characteristics of the positive impact of ERP on flexibility

Lemaire (2002) specifies that the integrated nature of ERP allows users to have more important analytical and synthetic power. That's stimulates effectively their responsiveness to changes. This is the case of accountants who see their work valued. In fact, they move towards tasks of higher value-added like analysis, interpretation, data synthesis and service coordination (Lemaire 2002).

Moreover, ERP allows employees to have a more important extent of autonomy and decision. Thus, in a turbulent situation, they are able to react quickly (Lemaire 2002, Bidan et al. 2002).

Besides, ERP allows the distribution of information, communication and coordination of work. ERP also reduces the time of transactions, which allows the firm to manage a broader range of tasks, thus improving its flexibility (Lucas and Olson, 1994). Moreover, it allows real-time control on employees and on activities. Consequently, ERP optimizes work in the firm and enables managers to have a holistic view of their organization. Thus, they can cope with any environmental change (Bidan et al. 2002).

In the same context, integration guarantees a decompartmentalisation of the various firm's services and a better coordination between them. Consequently it is able to manage transversely its operations (Bidan et al. 2002). The integration therefore stimulates the functional versatility of employees and their responsiveness (Lemaire 2002). Hence, the ERP's integration acts positively on the firm's flexibility.

As the relationship between ERP and flexibility is not strong and stable in empirical issues, we choose to moderate it throughout 3 variables: number of modules, firm size and period following the introduction of the ERP. This moderating effect will be discussed in more details in the next paragraph.

3 HYPOTHESIS AND RESEARCH MODEL

The first hypothesis is related to the direct relationship: ERP integration and flexibility. The three other ones propose to moderate this relationship by the number of modules, the firm size and the time period following the introduction of the ERP.

3.1 First hypothesis: the positive impact of ERP integration on the reactive strategic flexibility

ERP's Integrative effect allows sharing, access and timeliness of information flow throughout the organization and optimize the speed of decision-making and responsiveness. The firm is therefore more flexible (Uwizeyemungu and Raymond 2004).

Similarly, it is important to emphasize that improving the flexibility of the firm is listed among the top reasons for adopting an ERP system (Bidan et al 2002). This improvement is acting on various organizational aspects. First, it allows employees to focus on activities such as analysis, interpretation and synthesis. Second, it stimulates their intellectual capacities and improves their capacity to respond to changes (Lemaire 2002).

By reducing costs and data entry errors, it provides users with reliable, relevant and real-time information. Immediate access to these information allows employees to have a global view of their businesses and make them more independent and more involved in their work (Lemaire 2002). The ERP therefore stimulates the responsiveness of users and their alertness and provides them a greater decision-making authority. It also helps managing a greater number of tasks and reduces time transactions (Bidan et al 2002).

Bidan et al. (2002) conclusion points out the positive effect of ERP integration on the strategic flexibility of the firm. Thus, the first hypothesis is:

H1: The integration of ERP has a positive impact on the reactive strategic flexibility of the firm.

3.2 Second hypothesis: the moderating effect of modules number on the relationship ERP integration / reactive strategic flexibility

The number of modules variable describes the application modules installed in the firms (Bidan et al. 2002, El Amrani et al. 2006). Bidan et al. (2002) show that this variable has an impact on its flexibility. Their findings reveal the existence of a positive relationship between the ERP number of modules and various flexibilities of the firm. Thus, the number of modules has a dampening effect on the relationship between ERP and flexibility.

The authors have also demonstrated the existence of a level (8 modules) from which the effect of modules number increases considerably. In fact, the more the firm is integrated (increasing number of modules), the best flexible it is.

Similarly, El Amrani et al. (2006) stress that the effect of integration on flexibility is emphasized by the installation of a large number of modules. Hence, literature underscores the existence of a moderating effect of this variable on the relationship ERP and flexibility.

Indeed, being fully integrated, the company is more responsive and therefore more flexible. However, these researches examine the modules number variable as acting directly on flexibility. For this reason, we proposed to study the existence of a moderating effect of modules number on the relationship ERP/flexibility. Thus, the second hypothesis is:

H2: Modules number installed has a moderating effect on the relationship between the integration of ERP and reactive strategic flexibility.

3.3 Third hypothesis: the moderating effect of firm size on the relationship integration of ERP / reactive strategic flexibility

Organizations adopt more formal processes and systems as they increase in size. Accordingly, Mabert et al. (2003) argue that SMEs benefit more from integration offered by the ERP. In fact, large firms overlook the integrative capacity of the software. Indeed, large companies prefer to adapt the software to their specificities and this is why they spend more time in the implementation phase. Therefore, major part of large enterprises do not benefit from the full potential of ERP integration (Mabert et al. 2003). So, firm size may moderate the relationship between ERP and flexibility.

In the same context, Bidan et al. (2002) confirm that firm size is not related to the ERP integration and firm responsiveness. The difference between large enterprises and SMEs is the motivation that has led to the adoption of ERP. While large enterprises adopt ERP to improve their information systems, SMEs install it to increase their flexibility (Bidan et al. 2002).

However, Fehri and Khlif (2005) show, throughout a regression model, that ERP has a greater effect in large companies. Indeed, it acts positively through quick processing, distribution and sharing of information which improves decision making process. So ERP has a greater and more pronounced organizational impact in large companies than in SMEs. The different results of these studies lead us to say that firm size is able to moderate the relationship between integration and flexibility. Thus, the third hypothesis is:

H 3: Firm size has a moderating effect on the relationship between the integration of ERP and reactive strategic flexibility

3.4 Fourth hypothesis: the moderating effect of period following the installation of ERP on the relationship integration of ERP / reactive strategic flexibility

The more the time period following the implementation of an ERP is long, the better various organizational changes resulting from this system are likely to be noted. Indeed, several studies on ERP systems have emphasized the importance of the time factor on the organizational effects of ERP. Time is required in order to observe and study the impact of ERP on the firm (Nicolaou and

Bhattacharya 2006, Nicolaou 2004, Poston and Grabski 2001, Goodhue et al. 1992[3], Pilat 2004, Wieder et al. 2006, Ho, 2006).

In fact, employees need time to go beyond resistance generally observed meanwhile implementing the ERP. Thereafter they have to adapt to the new system, to experiment it and then to make it fit to their work specificities.

Both adaptations are important; the employee adaptation to the ERP and ERP adaptation to the specific needs of the organization (Bresnahan and Greenstein 1996)[4]. Hence, it is important to wait a certain period of time in order to observe the impact of ERP on flexibility. Consequently, the forth hypothesis is:

H4: Period following the installation of ERP has a moderating effect on the relationship between integration of ERP and reactive strategic flexibility.

Accordingly, figure 1 illustrates the research model of this study.

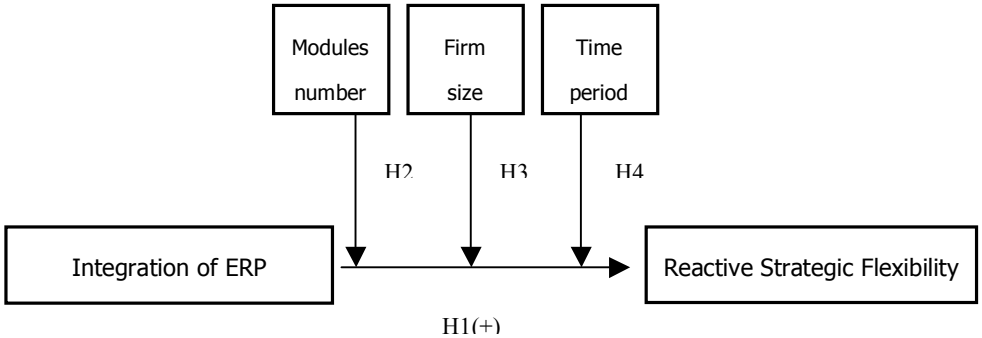

Figure 1. Research model.

4 METHODOLOGY AND RESULTS

We present in this paragraph the methodology adopted and then the different results found.

4.1 Population and Sample

Data for this study came from an electronic and face-to-face survey of firms in Tunisia carried out in the winter of 2007. The sampling method followed is convenience. In fact, we do not have an exhaustive list of firms having implemented an ERP in Tunisia. Indeed, we were able to have a list of firms that have implemented an ERP (MFG/PRO, Navision, Oracle, Adonix and JDEdwards) through Discovery Informatics (MFG/PRO), Oradist (Oracle) and Datasoft (Navision). The questionnaire was administered to 65 SME's after completing a pretest to 10 several individuals (students and professionals). We complete responses from 50 firms with a response rate is 77%.

The questionnaire encloses 19 items. All of them are measured on a Likert scale of 5-points. The questionnaire was sent to the respondent with a covering letter asking that the questionnaire be passed on to the person who helps implementing the ERP. It was felt that this person was likely to have a good knowledge of the effects of this implementation.

[3] Goodhue and al. (1992) in Hamilton, D. (1999), "Linking strategic information systems concepts to practice: systems integration at the portfolio level". *Journal of Information Technology*, 14, 69- 82.
[4] Bresnahan and Greenstein (1996) in Poston, R. and Grabski, S. (2001). "Financial impacts of enterprise resource planning implementations". *International Journal of Accounting Information Systems*, 2, 271-294.

4.2 Measuring strategic flexibility

A variety of different approaches have been used in previous studies to assess or measure firm flexibility. Given the difficulty of defining this latter, the most common approach is to identify the two largely frequent strategic dimensions; proactive and reactive one.

4.3 Measuring ERP integration

Similarly, ERP integration is various and complex. We choose Bidan et al 2002 way of measuring this variable. In fact, we can approach integration by the information, functional and technical components of the ERP.

4.4 Other measures

The moderating variables we examine are: firm size (measured by the number of employees), the number of module (measured by the number effectively installed by the firm) the time period following the installation of the ERP (measured by years).

4.5 Results

In a first step, we did a data reduction analysis for the measurement scale of the reactive strategic flexibility and that of the integration. In a second step, we draw a regression model to test the first hypothesis.

$$\text{Model 1 : } RF = a0 + a1\ INT1 + a2\ INT2 + a3\ INT3 + \varepsilon$$

with

RF : reactive flexibility
INT1 : information component of the integration
INT2 : functional component of the integration
INT3 : technical component of the integration

We test the absence of multicollinearity between variables. Similarly, the coefficients of Skewness (asymmetry) and Kurtosis (flattening) have enabled us decide on the normality of explanatory variables.

Variables	Regression coefficients
INT1	-0,492*
INT2	0,426*
INT3	-0,065
R	0,654
R^2	0,428
R^2 adjusted	0,390
F	11,456*

**Significant at 0.05 level*

Table 1. Regression analysis results

Results show that the three dimensions of integration explain 42.8% of the change in the reactive strategic flexibility. The information component has a significant regression coefficient (-0,492, p less than 5%). The functional component also has a significant regression coefficient on the threshold of 5% (0,426 and p less than 5%). As for the technical component, its regression coefficient is not significant. Accordingly, we can say that information component and functional component are significant predictors of the reactive strategic flexibility and that the technical component is not. So, the assumption H1 is partially confirmed.

In the third and final step, we did the hierarchical regression with the moderating variables to verify that the three of them -modules number, size and time-period following the installation of the ERP- have a moderating effect on the relationship between integration of the ERP and reactive strategic flexibility.

Model 2 : RF = a0 + a1 INT1 + a2 INT2 +a3INT3+a4 nbrmod+ a5 nbrmod INT1 + a6 nbrmod INT2 + a7 nbrmod INT3 + ε

with:

FR : reactive flexibility
INT1 : information component of the integration
INT2 : functional component of the integration
INT3 : technical component of the integration
nbrmod : modules number
nbrmod INTi : interaction terms with i from 1 to 3

Regression Model	Beta (interaction)	P (interaction)	R^2	R^2 Variation
Model 1			0,428	
Model 2 (with modules number + interaction)	-0,710 -0,545 0,048	0,159 0,410 0,902	0,465	0,037
Model 1			0,428	
Model 3 (with firm size + interaction)	8,877* -0,039 0,452	0,006 0,980 0,708	0,563	0,135
Model 1			0,428	
Model 4 (with period+ interaction)	0,571 0,661 0,060	0,181 0,092 0,819	0,516	0,088

**Significant at 0.05 level*

Table 2. R^2 variation

Results show no effect of all moderating variables on the relationship ERP\Flexibility. At this level, H2, H3 and H4 are rejected. H1 is partially accepted. However, it is necessary to emphasize the positive contribution of the functional dimension of integration on the strategic flexibility.

5 DISCUSSION AND CONCLUSION

The main focus of the study was on the relationship between ERP integration on strategic flexibility. The results revealed that the technical component of integration has no effect on reactive strategic flexibility of the company. We can explain this by the ERP interfacing with other software in most visited Tunisian companies. This interface is likely to alter the technical capacity of the ERP to integrate the various organizational parts.

The information component of the ERP integration acts negatively on the strategic flexibility. Indeed, the user of the ERP being confronted to information from different functions may face a problem of management, understanding of this information and confusion in decision-making. In this way, the decision process is slowed which acts negatively on the responsiveness and firm flexibility.

Similarly, ERP accentuates control because it allows the traceability of all transactions. Thus, some employees see their supervisor before taking any decision which is likely to reduce their responsiveness. And hence, the strategic flexibility of the company decreases.

In this context, we emphasize the triad mentioned by Everaere (1997) namely "competence, motivation and coordination." This triad is necessary for successful integration. Indeed, to avoid the negative impact of information component of integration on the strategic flexibility, employees should have the necessary skills to manage and use information (especially those from departments in which they do not work). They should also be motivated by the idea of exchanging and sharing this information. Finally, they should coordinate their work so as to have quick and efficient movement of information. At this stage, we underline the importance of the manager role in the selection and training of ERP users.

The functional dimension of integration is acting positively on the reactive strategic flexibility. An instantaneous exchange of information between different firm functional units allows any decision maker to have a global vision of his organization. Therefore, he or she is able to take a decision at any time and especially in case of unexpected event.

This dimension also allows a more rapid movement of information between functions. Thus, transactions and operations carried out in less time. Similarly, communication, coordination and cooperation among different functions are enhanced by this functional component of integration. Hence, the firm reaction will be faster. So ERP stimulates flexibility through the functional component of its integrative effect.

Accordingly, these findings lend support to some of the main recommendations of the normative literature on ERP implementation. One of the main thrusts of much of this literature is that ERP allow more flexibility to the firm if the managers are more informed and conduct by themselves the implementation. This better serves the needs for the learning and adaptation required when strategic change is underway. In addition, we can underline the fact that the firm size, the number of modules and the time-period of implementation do not have moderating effect on the studied relationship.

Some care is needed in interpreting these findings. There are other possible explanations of the weak correlations between ERP integration and strategic flexibility. Perhaps most importantly these could result from “common source variation” i.e. all our responses came from one respondent in each organization, which may introduce some systematic bias. Alternatively there may be other causal variables moderating the relationship.

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